

# FCS07 - SOP for Operating and Maintaining Balances

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## 1. Scope

- 1.1. This document establishes the procedures for operation, preventative maintenance, and quality control that apply to balances. The purpose of these maintenance and quality control (QC) procedures is to ensure that balances within the Forensic Chemistry Unit (FCU) are working properly and are free of contaminants before processing casework.

## 2. Background

- 2.1. To establish a procedure for regular balance operation, maintenance, and QC to ensure quality and accuracy of reported casework results.

## 3. Safety

- 3.1. Reagent Toxicity:

- 3.1.1. Personnel should refer to the appropriate SDS for solvents and reagents used during analysis for any specific safety requirements.

- 3.1.2. For a complete review of required Health and Safety regulations of the Forensic Science Laboratory (FSL), see *DOM13 - DFS Health and Safety Manual*.

- 3.2. Protective Equipment:

- 3.2.1. Personnel should wear personal protective equipment (PPE) including:

lab coat, gloves, and safety goggles when carrying out standard operating procedures.

3.2.2. Wear vinyl or nitrile gloves when handling these chemicals to prevent absorption through the skin. If any chemicals are spilled onto gloves, discard gloves into hazardous waste.

3.3. Training:

3.3.1. Formal training in use of balances is necessary.

3.4. Personal Hygiene:

3.4.1. Universal Precautions must be followed. Care should be taken when handling chemicals or any biological specimen. Routine use of gloves and proper hand washing should be practiced.

3.4.2. Refer to DOM13 – DFS Health and Safety Manual.

3.5. Disposal of Waste:

3.5.1. Waste materials must be disposed of in compliance with laboratory, Federal, state, and local regulations. Solvents and reagents should always be disposed of in an appropriate container clearly marked for waste products and temporarily stored in a chemical fume hood.

3.5.2. Consult DFS Safety Officer for proper procedures.

## 4. Materials Required

4.1. Cleaning solvent (e.g., Ethanol)

4.2. Analytical, precision, or top-loading balances

4.3. QA Log(s) and Control Chart(s)

## 5. Standards and Controls

5.1. Certified Standard Weights, calibrated and traceable to the International System of Units (SI).

## 6. Calibration

6.1. Balances shall be calibrated annually (i.e., once per calendar year) by an accredited external vendor. Calibrations shall be metrologically traceable.

6.2. Standard weights shall be calibrated or replaced annually, unless a longer time span is specified on calibration certificates. Calibrations shall be metrologically traceable and performed by an external accredited vendor.

## 7. Procedures

### 7.1. General Operational Procedures

#### 7.1.1. Prior to each use:

7.1.1.1. Ensure balance is level

7.1.1.2. Ensure balance is free of debris or contaminants (clean with Ethanol and/or brush if necessary)

7.1.2. Tare the balance, with all doors closed (if applicable)

7.1.3. Place the item on the balance, close all doors (if applicable), record weight when balance is stable.

7.1.3.1. Note: For specific procedures relating to weighing evidence in casework, refer to *FCS01 – SOP for Detecting Controlled Dangerous Substances*.

### 7.2. Performance Verification of Balances

7.2.1. Prior to being used in casework, newly purchased balances shall undergo a performance verification to ensure it meets manufacturer's specifications and that results are produced as expected.

7.2.2. Performance verifications shall consist of the following:

#### 7.2.2.1. Accuracy Study

7.2.2.1.1. Weigh three certified standard weights five times each per day for three consecutive days. Low, medium, and high test weights will be established based on the readability and weighing range of the balance (see Table 1).

7.2.2.1.2. Acceptance criteria: Low and high end tolerances for each balance will be established as ten times the readability value.

**Table 1:** Balance Acceptance Criteria

	Readability (g)	Weights (g)	Tolerance Range (g)
Analytical	0.00001	0.01000 0.10000 2.00000	0.00990 - 0.01010 0.09990 - 0.10010 1.99990 - 2.00010
	0.0001	0.01000 0.1000 2.0000	0.0090 - 0.0110 0.0990 - 0.1010 1.9990 - 2.0010

	0.001	0.100 10.000 200.000 <b>or*</b> 100.000	0.090 - 0.110 9.990 - 10.010 199.990 - 200.010 <b>or*</b> 99.990 - 100.010
<b>Top Loading</b>	0.01	2.00 10.00 200.00	1.90 - 2.10 9.90 - 10.10 199.90 - 200.10
	0.1	200.0 2000.0 10000.0	199.0 - 201.0 1999.0 - 2001.0 9999.0 - 10001.0

#### 7.2.2.2. Repeatability Study

7.2.2.2.1. Use the fifteen medium test weight values from the accuracy study.

7.2.2.2.2. Relative standard deviation of values must be within  $\leq 2\%$ .

#### 7.2.2.3. Uncertainty Assessment

7.2.2.3.1. All data will be used for an initial uncertainty calculation.

### 7.3. Weekly Maintenance

7.3.1. Weekly Maintenance must be carried out each week on each balance used for casework and must be performed prior to any other casework. Only the balances being used for active casework must undergo this weekly maintenance.

7.3.2. Each Monday is considered the start of a new week for weekly maintenance purposes.

#### 7.3.3. Procedure

7.3.3.1. Visually inspect balance to ensure clean; clean, if necessary, with a wipe or brush and let dry prior to use.

7.3.3.2. Press internal adjustment button, if applicable.

7.3.3.3. Tare the balance.

7.3.3.4. Performance check:

7.3.3.4.1. Perform a weight test on three weights appropriate for the weighing range of the balance used (one low, one medium, and one high; refer to Table 1).

7.3.3.4.2. Record test weights in the corresponding Balance QA Log (Document Control Number 4380).

7.3.3.4.3. Test weights must be within the tolerance ranges established in Table 1.

7.3.3.5. Acceptable performance specifications will be assessed prior to use of the balance. Records shall be maintained in a Balance Control Chart.

7.3.3.6. If the test weights are outside the acceptance specifications of a test mass, the analyst shall follow Section 5.8 Malfunctioning Equipment of *DOM05 – Procedures for Instrument Checks and Maintenance*.

7.3.3.6.1. The balance shall be put back into service upon subsequent demonstration of measuring weights within acceptance range (i.e., by performing weekly maintenance and performance check)

#### 7.4. As-Needed Maintenance

7.4.1. Weekly maintenance and a performance check must also be completed after any service interruption that may modify the function of the equipment (i.e., movement of location).

#### 7.5. Calibration Schedule

7.5.1. See Section 6 for calibration schedule.

### 8. Sampling

8.1. Not applicable

### 9. Calculations

9.1. Not applicable

### 10. Uncertainty of Measurement

10.1. Uncertainty of measurement is calculated based on the following factors:

10.1.1. Process reproducibility

10.1.1.1. Process reproducibility accounts for user and environmental variations, based on weekly performance check data.

10.1.2. Resolution of measurement

10.1.2.1. Resolution of measurement accounts for the readability value of the balance.

10.1.3. Balance calibration uncertainty

10.1.3.1. Annual calibrations should include an uncertainty study performed by the vendor. Balance calibration uncertainty is obtained from the most recent calibration service certificate.

10.1.4. Standard weight uncertainty

10.1.4.1. Standard weight uncertainty accounts for the uncertainty of test weights used for performance checks.

10.2. Uncertainty of measurement is assessed on an annual basis.

10.3. See *FCS21 – Procedure for Uncertainty in Measurement*

## 11. Limitations

11.1. Not applicable

## 12. Documentation

12.1. Balance QA Log (Document Control Number 4380)

12.2. Balance Control Charts

## 13. References

13.1. DFS Departmental Operations Manuals, (current revisions).

13.2. Forensic Chemistry Unit SOPs, (current revisions).